New Brunswick
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Guide to Operations

Galaxy S Series
170 S CO_2 Incubator

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CAUTION!

This equipment *must* be operated as described in this manual. If operational guidelines are not followed, equipment damage and personal injury *can* occur.

Please read the entire User's Guide before attempting to use this incubator.

Do not use this equipment in a hazardous atmosphere or with hazardous materials for which the equipment was not designed.

New Brunswick Scientific (NBS) is not responsible for any damage to this equipment that may result from the use of an accessory not manufactured by NBS.

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Manual Conventions

NOTE: **Notes contain essential information that deserves special attention.**

CAUTION! ***Caution*** **messages appear before procedures which, if caution is not observed, could result in damage to the equipment.**

WARNING! ***Warning*** **messages alert you to specific procedures or practices which, if not followed correctly, could result in serious personal injury.**

WARNING! **This particular *Warning* message represents a potential electrical hazard.**

This particular *Warning* message, whether found in the manual or on the incubator means HOT SURFACE–and therefore represents a potential danger to touch.

CRUSH WARNING! ***Crush Warning*** **messages alert you to specific procedures or practices regarding heavy objects which, if not followed correctly, could result in serious personal injury.**

This symbol on the incubator is a reminder that it is of essential importance to read the user manual.

WARRANTY
Every Instrument manufactured by
New Brunswick Scientific (NBS) is warranted to be free
from defects in material and workmanship. This apparatus, with
the exception of glassware, lamps and electrodes (where supplied),
is warranted for 2 years against faulty components & assembly and
our obligation under this warranty is limited to repairing or replacing
the instrument or part thereof which shall within 2 years following
date of shipment prove to be defective after our examination.
Incubator accessories are warranted for 1 year. This warranty does
not extend to any NBS products which have been subjected
to misuse, neglect, accident or improper installation or
application; nor shall it extend to products which
have been repaired or altered outside the NBS
factory without prior authorization from the
New Brunswick Scientific.

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1 INTRODUCTION

The Galaxy 170 S CO_2 incubator is microprocessor-controlled and designed to ensure accurate and reliable operation. The incubator incorporates a simple, door-mounted touch-sensitive keypad with two individual three-digit LED displays that allow for easy programming and monitoring of the chamber conditions.

A direct heat system, utilizing a thermal heating element, completely surrounds the incubator, providing an even temperature within the chamber. The independently heated outer door is designed to ensure an even distribution of heat. This system ensures a rapid, controlled return to optimum chamber conditions after a door opening while also preventing any overshoot.

A solid-state infrared sensor is used to control the level of CO_2, providing excellent reliability and remaining unaffected by humidity.

The 170-liter chamber is seamless to provide a sanitary and easy-to-clean environment. The perforated, non-tip shelves, shelf racks and humidity tray are easily removed without tools for thorough cleaning and are capable of being sterilized. Air circulation is achieved without the use of a fan, eliminating ductwork (a potential source of contamination), simplifying cleaning, eliminating vibration and reducing small sample evaporation within the chamber.

An independently controlled water tray at the bottom of the incubator allows a high, uniform relative humidity while preventing condensation in other parts of the chamber. Perforated shelves are provided as standard to facilitate a much faster recovery of RH conditions in the chamber than with unperforated shelves.

The incubator incorporates a two-level alarm system. The chamber-monitoring alarms are programmable and will alert you if temperature or CO_2 have not recovered within a preset time after the door has been opened. If it is not required, this system can be disarmed. The system alarms occur only if a problem has developed with system components that need to be rectified by user intervention. The incubator also incorporates an over-temperature safety system that operates independently from the main control system.

The incubator's direct heat system was designed with optimal use of laboratory space in mind: it allows the most efficient internal volume for the footprint of the instrument. In addition, the incubator's top panel is specifically designed to support the weight of another Galaxy 170 S or a Galaxy 170 R incubator stacked directed on top of the first.

The Galaxy 170 S model contains many standard features usually seen as options. It has a sealing inner door with a cam action lock to allow visualization of the cultures without compromising the internal atmosphere. This is also available as a split 4- or 8-inner-door option (to coordinate with shelves), which is ideal for critical hypoxic studies. In addition, there is a 25mm access port now standard to allow for seamless integration of independent probes or other equipment through the chamber. Lastly, NBS has included an RS232 port as standard on all Galaxy S series incubators. This port will communicate with any computer through a hyperlink access or can be used to externally datalog the incubator through NBS software.

The incubator features multiple options that can be installed to simplify maintenance and provide superior control over experimental conditions. For example, high-temperature disinfection quickly and conveniently disinfects the incubator's chamber at 120^{o}C, without the need to remove interior components or the CO_2 sensor. These and other options and accessories provide for a uniquely flexible CO_2 incubator capable of meeting the most demanding requirements.

2 UNPACKING & INSTALLATION

2.1 Inspection of Boxes

After you have received your order from New Brunswick Scientific (NBS), inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage to the carrier and to your local NBS distributor immediately.

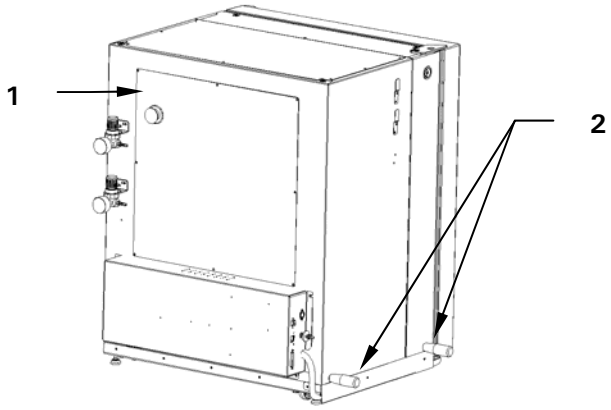
2.2 Unpacking

CRUSH WARNING!
At least four people are required to safely lift your Galaxy 170 S.

Disassemble the wooden shipping crate and remove the protective packing. Save the packing materials for possible future use, and be sure to save this User's Guide for instruction and reference.

To simplify lifting the incubator, leave it on the pallet as you install the four lifting handles provided (*see Figure 1a*) by screwing them **fully** into the tapped holes on both sides. You must have at least two persons at either side to safely lift the incubator. *Supported by the lifting handles only*, lift the incubator from the delivery pallet.

Figure 1a: Removable Lifting Handles



1	Rear of incubator	2	Removable lifting handles

CAUTION!
NEVER try to lift the incubator by its door; this would cause permanent damage to the incubator.

Locate and remove the parts stored in the Humidity Tray.

If any part of your order was damaged during shipping, is missing, or fails to operate, please contact your New Brunswick Scientific (NBS) distributor.

Using your NBS packing list, verify that you have received the correct materials, and that nothing is missing.

Table 1 outlines the accessory items that are supplied with your new incubator:

Table 1: Accessories Provided

Quantity	Item	Notes
4	Screw-in Lifting Handles	Installed
4	Non-tip Shelves	Installed
2	Wire Shelf Racks (one for each side)	Installed
1	Humidity Tray	Installed
1	White porous CO_2 Sensor Cover	Installed
1	Black CO_2 Sensor Cover	Installed
1	Power Cord	Packed in clear accessories bag
3 m	PVC Tubing, ~ 6mm bore, with an inline CO_2 HEPA-filter connected, ready for use	Packed in clear accessories bag
2	Hose Clips	Packed in clear accessories bag
4	Adjustable Feet, with locking nuts	Packed in clear accessories bag
4	Anti-slip Pads for adjustable feet	Packed in clear accessories bag
1	User Manual	Supplied

WARNING!

Anytime you touch or handle the white CO_2 sensor cover, be sure to wear gloves, and do not later touch those gloves to your face. Discard or wash the gloves.

2.3 Utilities

In order to use the incubator, you will need:

Table 2: Utilities

Utility	Requirement
Electricity	110/120V, 50/60 Hz grounded electrical supply with min. capacity of 10 amps
	OR
	220/240V, 50 Hz grounded electrical supply with minimum capacity of 8 amps
CO_2 Gas	Cylinder with 100% CO_2 vapor withdrawal, together with a two-stage regulator for pressure control to 5 psi (0.35 bar)

2.4 Location

The incubator is designed to operate at a chamber temperature of 4.0°C above ambient, and at an absolute minimum ambient temperature of 15°C if the incubator is being used at 37°C.

NOTE:
Optimal operating conditions are at an ambient temperature of 20-25°C.

Care should be taken to avoid placing the incubator in a position that may affect its performance, such as those listed below.

DO NOT place the incubator:

- **Directly under, beside or within the air-flow of heating or air-conditioning ducts, or other drafts;**
- **Directly beside heat generating equipment such as a heater, an autoclave or oven;**
- **Near the exhaust of heat- or cold-generating equipment (like a ULT freezer);**
- **Near a window exposed to direct sunlight.**
- **Directly on top of any heat-generating apparatus.**
- **Without a minimum of a 10mm ventilation gap all-round, 45mm to the hinge side of the incubator allowing for door opening.**

CAUTION!
NEVER try to lift the incubator by its door; this would cause permanent damage to the incubator.
NEVER lean on or place objects on the open door.

Remove the incubator from the pallet and place the incubator in the working position, on a level surface capable of bearing its weight (approximately 90 kg; actual use weight will be heavier and will depend on the options installed and the material stored in the incubator).

The incubator is designed so that one incubator can be safely stacked on top of another incubator using the available stacking kit. It is not possible to put any other type of incubator or heavy apparatus on top, as the top cover and stacking kit are designed to support only the feet of another 170 S or 170 R incubator.

NOTE:
When the incubator is securely in place, remove the four lifting handles. Store them in a safe place for future use.

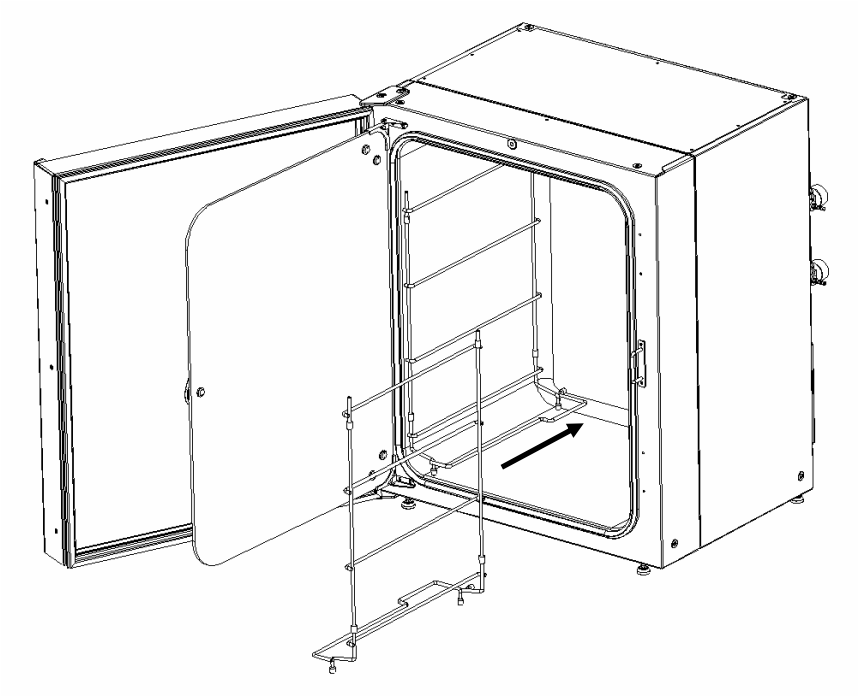
2.5 Setting Up

Place the anti-slip covers provided onto the incubator's front feet; keep them installed at all times.

Install the wire shelf racks and shelves, and level the incubator:

1. *Oriented as shown in Figure 1*, place the shelf racks inside the chamber. Each rack has three rubber feet: two stand on the floor of the chamber, and one stands against the back wall. Make sure the cushioned tubing spacers are snug against the side walls; these spacers allow clearance for the shelves.

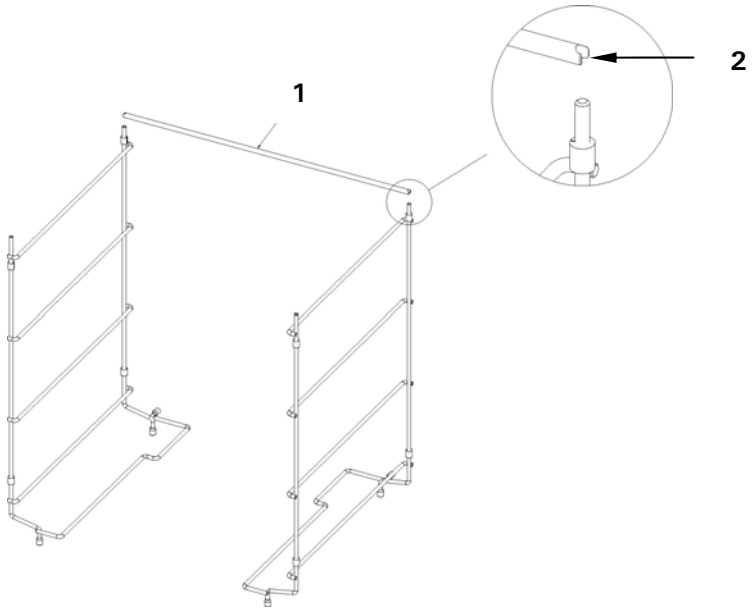
Figure 1: Inserting Shelf Racks



NOTE:
Only shelf racks for 4 shelves are shown in this manual. Shelf racks for 8 shelves are also available.

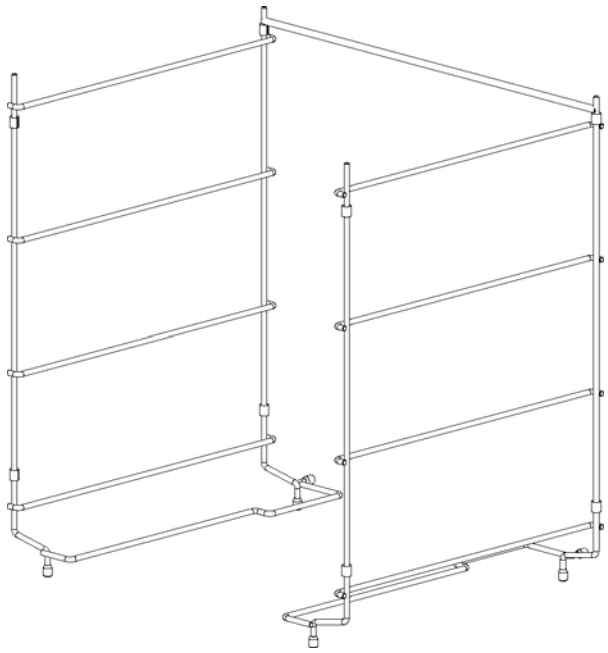
2. Install the tie rod at the back of the shelves to hold both sides together, as shown in Figures 2 & 3 on the following page. You may prefer to do this prior to inserting the racks in the chamber.

Figure 2: Fitting Tie Bar to Shelf Racks



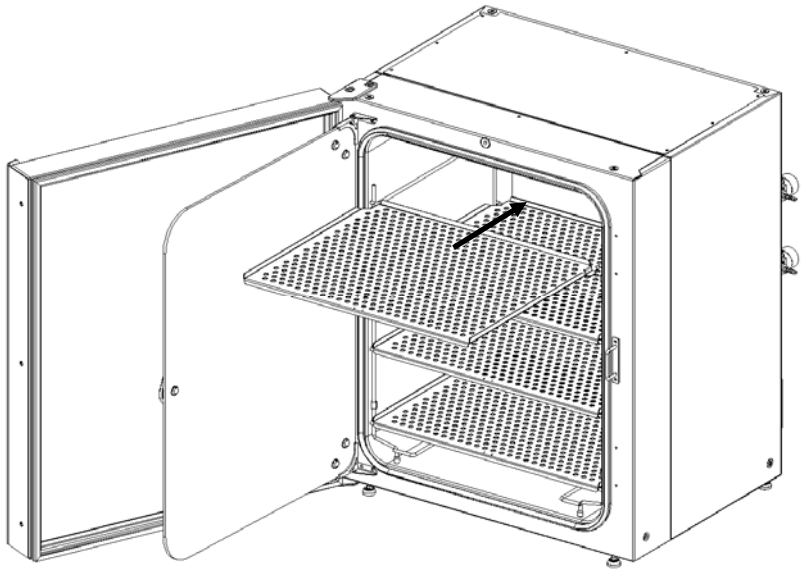
1	Tie bar
2	Detail (2:3 scale) shows the tie bar's anti-tip groove.

Figure 3: Shelf Rack Assembly



3. Install the shelves (*see Figure 4)*, beginning at the top. Make sure that each shelf's anti-tip groove is properly inserted onto each of the shelf rack guides.

Figure 4: Inserting Shelves



4. Level the incubator by adjusting the feet. Place a small level on the second shelf of the incubator. Adjust the levelling feet until the incubator is level and stable. Lock the leveling feet in place by tightening the locking nuts on each foot.

5. Slide the humidity tray onto the lowest shelf rack supports, which are shaped with stops to keep the tray in place (*see Figures 5 & 6*).

Figure 5: Installing the Humidity Tray

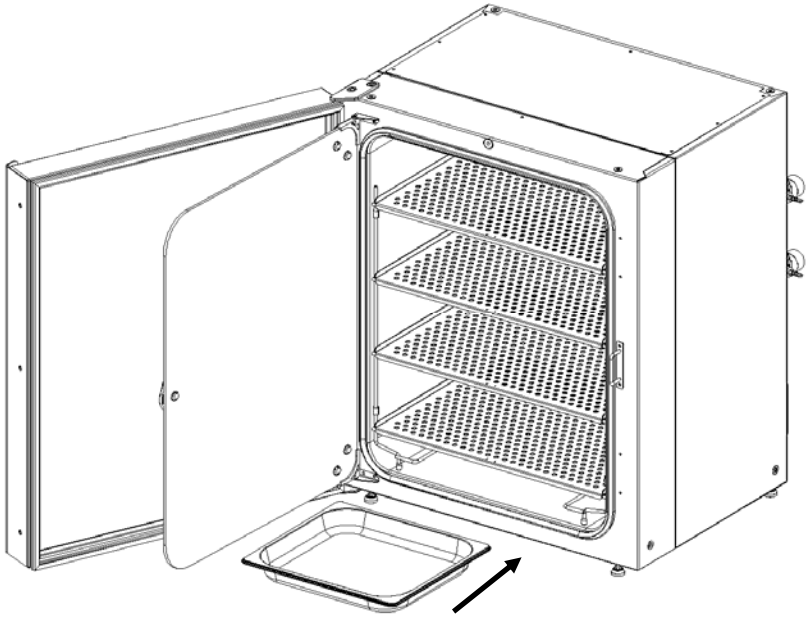
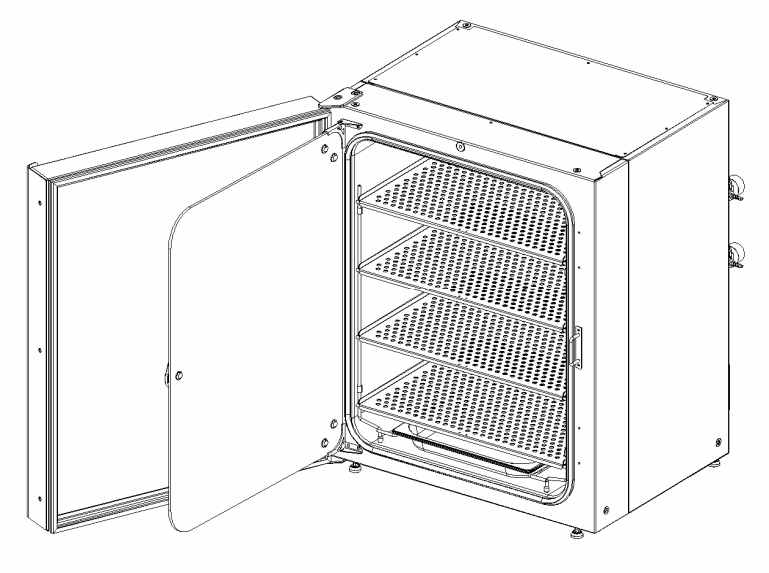


Figure 6: Humidity Tray, Installed



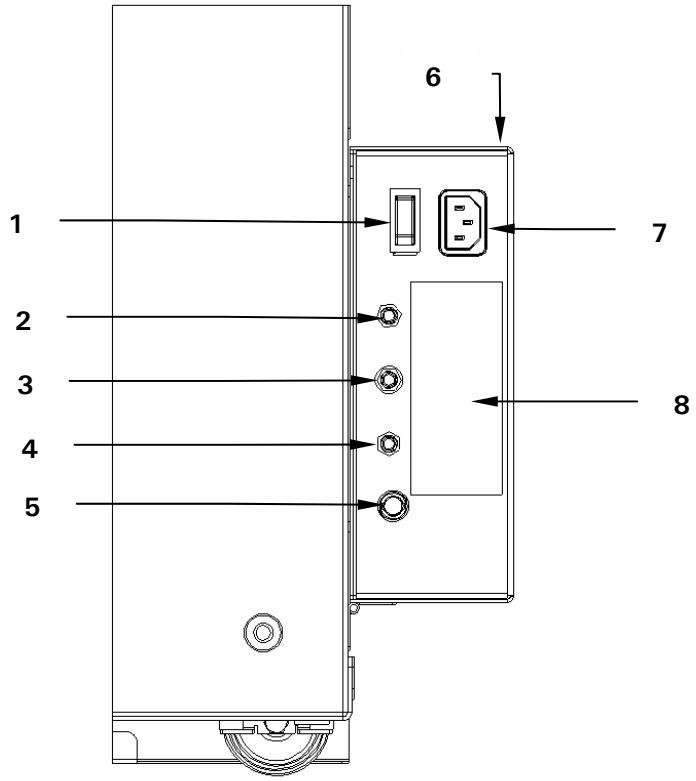
2.6 Making Connections

> ***WARNING!***
> **Slightly increased levels of CO_2 may be found in and around the operating area of the CO_2 incubator. Over time, this can have adverse effects on those exposed to such an environment. Users working in environments with elevated levels of CO_2 should take all appropriate precautions to protect their breathing.**

Connect the CO_2 gas supply:

1. Connect the incubator to the CO_2 supply using the 6mm plastic tubing (with installed HEPA filter) by attaching the tubing from the two-stage regulator (or in-line regulator) to the matching CO_2 inlet on right side of the equipment tray (*see Figure 7 on the following page*).

Figure 7: Making Connections



1	ON/OFF switch	5	Fuse holder
2	Not used at this time	6	Righthand side of equipment tray
3	CO_2 inlet	7	Power cord receptacle
4	Not used at this time	8	Label

NOTE:
It is highly recommended that an in-line regulator be used at the incubator's gas inlets.

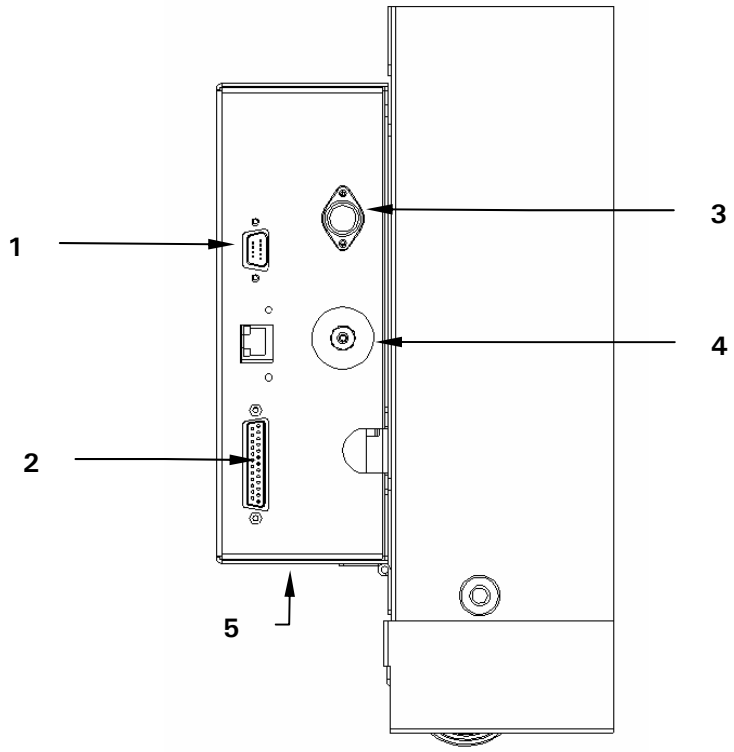
For proper incubator operation, CO_2 gas pressure must not exceed 5 psi (0.35 bar).

An in-line regulator can be fitted to the rear of the incubator (*see Figure 10 for location*).

2. Use the tubing clips provided to eliminate CO_2 leaks.

Install the Auto Zero HEPA filter by pressing it gently into the white plastic filter socket (*see Figure 8 on the following page*) on the left side of the equipment tray.

Figure 8: AutoZero HEPA Filter & Fitting



1	RS232 socket	4	AutoZero HEPA filter
2	Not used at this time	5	Lefthand side of equipment tray
3	Optional BMS relay contact alarm socket (see Section 8.1 for details).		

WARNING!

Before making electrical connections, verify that your power supply voltage matches the voltage of your incubator and that the on/off switch is in the OFF position.

Install the power cord:

1. Insert the power cord into its receptacle on the right side (facing the incubator) of the equipment tray (*see Figure 7 on the previous page).*

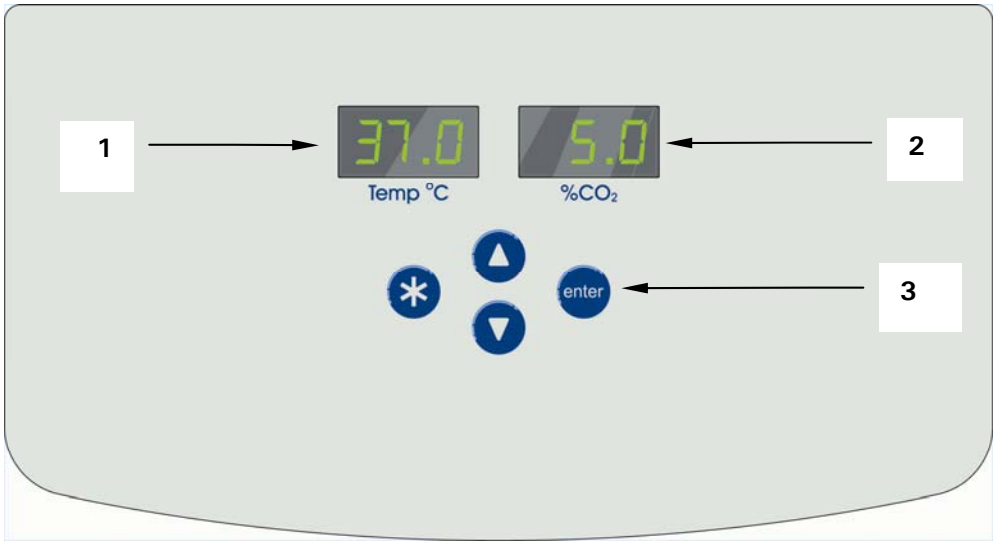
2. After verifying that your supply voltage matches the voltage specified for your incubator and that the ON/OFF switch is OFF, plug the cord into your power supply outlet.

3 OPERATION

3.1 Control Panel

The control panel consists of two individual three-digit LED displays, and four function keys:

Figure 9: Control Panel



1	Temperature display	(shown in normal operation at factory setpoint)
2	CO_2 display	
3	Function keys	(see Table 3 for explanation)

Table 3: Function Keys

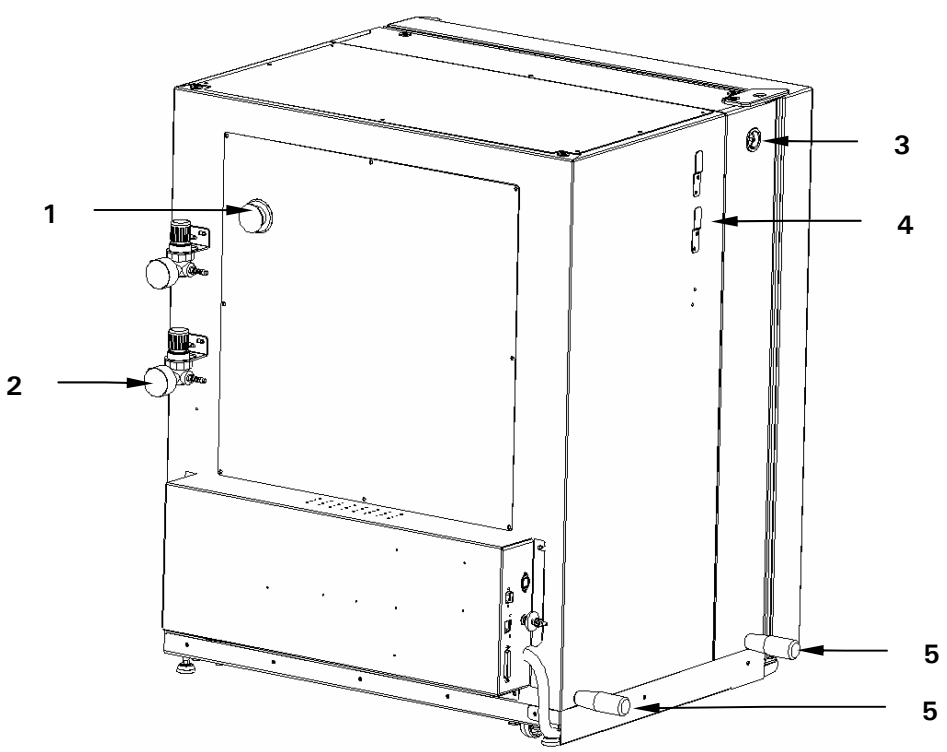
Key Symbol	Key Name	Function
*	Programming	Press this key to enter Programming mode, and to set values in either display.
▼	Down	In Programming mode, use this key to scroll down through numbered values in the display. Press this key simultaneously with the **Enter** key to access the Alarm system.
▲	Up	In Programming mode, use this key to scroll up through numbered values in the display.
enter	Enter	Press this key to save a new setpoint. Press this key simultaneously with the **Down** key to access the Alarm system.

NOTE:
If you accidentally press both the Up and Down keys simultaneously, you will engage Engineering Mode: press the Programming key *immediately* to exit.

3.2 Preparing for Operation

1. Remove the black protective cover from the CO_2 sensor, taking care not to remove the white porous cover. Store the black cover for use when you clean the incubator. There is a storage holder on the left side of the equipment tray (*see Figure 10*).

Figure 10: CO_2 Incubator Rear View



1	Access port	4	Sensor cover holder
2	Location for mounting in-line regulators	5	Removable lifting handles
3	CO_2 sample port		

2. Ensure that the white porous sensor cover is in place.
3. Remove the silica gel desiccant sachet.
4. Using the power cord provided, connect the incubator to a grounded power supply.
5. Turn on the incubator; the display will illuminate. Humidifying begins when the temperature reaches the programmed level.

NOTE:
If the power receptacle has a switch, make certain the power receptacle is switched on. When the incubator turns on, the decimal points on the display for Temperature and CO_2 flash on and off to signify that the Alarm System is not armed.

6. Turn on the gas supply with the pressure set to 5 psi or 0.35 bar when the incubator is at the programmed temperature.

NOTE:
CO_2 will not come on until the programmed temperature has been reached. Verify that the gas supply connections are secure: gas leaks not only affect performance, they will also deplete the gas supply.

7. The chamber setpoints are pre-programmed at 37.0°C and 0.0% CO_2.

8. If you are not planning to humidify the incubator, leave the humidity tray in place and ***skip to Step 4 in Section 3.3 below***.

3.3 Using the Humidity Tray

1. Fill the humidity tray with 1.5 liters of warm (~ 37.0°C) distilled water.

2. *For cell culture work*, we recommend the addition of one small teaspoonful (3.2g) of copper sulphate (or another recognized biocide) in the humidity tray. Tests have shown that in addition to inhibiting bacterial growth in the tray, this can reduce contamination on the chamber walls.

3. *For IVF and other sensitive work*, we do not recommend the use of any biocide in the humidity tray. To reduce the possibility of contamination, every 10 - 14 days the humidity tray water should be changed and the humidity tray should be cleaned with a solution of 70% isopropyl alcohol and 30% distilled water.

CAUTION!
Never leave water in the humidity tray if the incubator is switched OFF, as this may cause damage to the CO_2 sensor.

4. Let the incubator run until programmed conditions are achieved (preferably overnight), to allow conditions to stabilize within the incubator before use.

3.4 Setting Temperature & CO_2

At this time, program the desired temperature and CO_2 setpoints. Temperature and CO_2 may be set within these ranges (*see Table 4 on the following page*):

Table 4: Temperature & CO_2 Setpoint Ranges

Parameter	Available Setpoint Range
Temperature	10ºC to 50ºC (must be at least 4ºC above ambient)
CO_2	0.2% to 20%

To set the Temperature:

1. Press the Programming (∗) key. The temperature display will flash.
2. Press the Up (▲) or Down (▼) key until the desired value appears in the left display.
3. Press the **enter** key to save the setpoint. The CO_2 display will flash.
4. Now you can set the CO_2 level.

To set the CO_2 level:

1. Press the up (▲) or down (▼) key until the desired value appears in the right display.
2. Press the **enter** key to save the setpoint.

If at any time you wish to change the CO_2 level without adjusting the temperature setpoint, press the Programming (∗) key to work in the CO_2 display, then press the **enter** key.

NOTE:
Allow the incubator to stabilize at the setpoints selected before continuing.

3.5 Programming the Alarm System

3.5.1 Setting High & Low Temperature Alarms

1. Press the **enter** & ▼ keys simultaneously to enter Alarm Program Mode. The display will show: °C.AL.
2. Press the **enter** key to display the High Temperature Alarm, HI37.5. The factory setting is the setpoint value (37.0°C) plus 0.5°C.
3. If you wish to adjust the High Temperature Alarm, use the Up (▲) or Down (▼) key. The minimum setting, however, is 0.5°C from setpoint.
4. Press the **enter** key to save the setting, whether or not you have changed it. Now the Low Temperature Alarm is displayed, LO 36.5. The factory setting is the setpoint value (37.0°C) minus 0.5°C.
5. Use Up (▲) or Down (▼) if you wish to adjust the value.
6. Press the **enter** key to accept the setting, whether or not you have changed it.
7. Press the Programming (∗) key twice to exit the menu.

3.5.2 Setting the CO_2 High & Low Alarms

1. Enter the Alarm Program Mode (*see Step 1 of Section 3.5.1 above*), then press the ▲ key until the display shows: CO2AL.
2. Press the **enter** key to display HI.5.5. The factory setting is the setpoint value (5.0%) plus 0.5%.
3. If you wish to adjust the High CO_2 Alarm, use the ▲ or ▼ key. The minimum setting, however, is 0.5% from setpoint.
4. Press the **enter** key to save the setting, whether or not you have changed it. Now the low CO_2 Alarm is displayed, LO 4.5. The factory setting is the setpoint value (5.0%) minus 0.5%.
5. Use the the ▲ or ▼ key if you wish to adjust the value.
6. Press the **enter** key to accept the setting, whether or not you have changed it.
7. Press the Programming (∗) key twice to exit the menu.

3.5.3 Door Open Alarm

When you open the door, an alarm will sound after a preset time delay. If you wish to adjust the time delay:

1. In Alarm Program Mode (*see Step 1 of Section 3.5.1 above*), press the ▲ key until the display shows DOO.RAL (reading across both displays)**.**
2. Press the **enter** key and the ▲ & ▼ keys to adjust the time (as you scroll through the available choices, you will see 15, 30, 45, 60, 75, 90 seconds, then OFF).
3. Press the **enter** key to save the desired value.
4. Press the Programming (∗) key twice to exit the menu.

3.5.4 Alarm Duration

The following steps will adjust the length of time during which **all audible alarms** will last:

1. In Alarm Program Mode (*see step 1 of Section 3.5.1 above*), press the ▲ key until the display shows PER.IOD (reading across both displays)**.**
2. Press the **enter** key and the ▲ & ▼ keys to adjust the Alarm duration (as you scroll through the available choices, you will see OFF, 10 sec, 30 sec, 60 sec, 600 sec, 1 HR, then ON).
3. Press the **enter** key to select the desired value.
4. Press the Programming (∗) key twice to exit the menu.

3.5.5 Alarm Arming Delay

This is the length of time that is allowed for the Temperature and CO_2 to recover after opening the incubator before the Alarm System is armed again. This helps prevent unnecessary alarms from occurring.

To change the delay:

1. In Alarm Program Mode (*see step 1 of Section 3.5.1 above*), press the ▲ key until the display shows **DR .DEL** (across both windows).
2. Press the **enter** key and the ▲ & ▼ keys to adjust the Alarm Arming time (as you scroll through the available choices, you will see **0.15** Hr, **0.20**, **0.30**, **1.00**, then **OFF**).
3. Press **enter** to select the desired value.
4. Press ∗ to return to the main alarm programming menu, and press ∗ again to return to the main display.

NOTE:
When alarm delay is set to OFF, the Alarms will arm only when the programmed setpoint is reached.

3.6 Chamber Alarm System

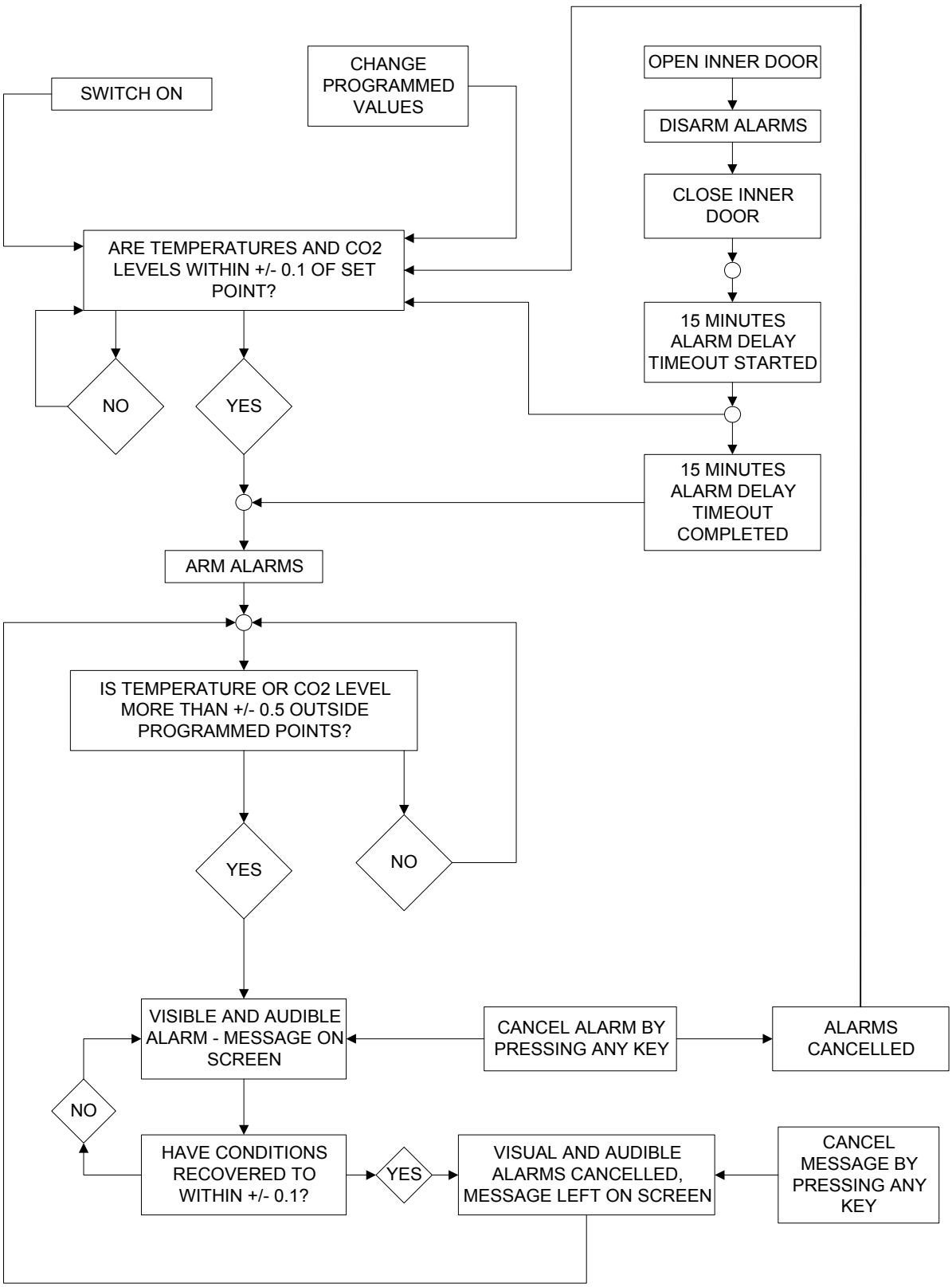
When the incubator is switched **ON**, or after any values have been reprogrammed, the Alarm System is inactive until the setpoint values (± 0.1) are achieved, after which the Alarm System is armed. *See Figure 11,* Chamber Alarm System Flow Chart*, on the following page.*

If temperature and/or CO_2 levels deviate more than the programmed amount, the display flashes, the audible alarm sounds and a message appears on the screen. You can acknowledge (and cancel) the alarm by pressing any key.

When the door is opened, the Alarm System is disabled. When you close the door, the preset Alarm Arming Delay starts. When the delay time expires, the Alarm System is rearmed; if the temperature and/or CO_2 fall below or above the alarm setpoints, the alarm will be activated. If chamber conditions recover within the Alarm Arming Delay time, the Alarm System will be rearmed but no alarm will be activated.

If an alarm is not acknowledged but the chamber conditions subsequently recover, the audible alarm will be cancelled but the alarm message will remain on the screen to alert the user to the fact that an alarm has occurred. You can cancel this alarm message by pressing any key. The duration of the audible alarm can be adjusted from inactive to continuous (s*ee Section 3.5.4 above*).

Figure 11: Chamber Alarm System Flow Chart


SWITCH ON
CHANGE PROGRAMMED VALUES
OPEN INNER DOOR
DISARM ALARMS
CLOSE INNER DOOR
ARE TEMPERATURES AND CO2 LEVELS WITHIN +/- 0.1 OF SET POINT?
15 MINUTES ALARM DELAY TIMEOUT STARTED
NO
YES
15 MINUTES ALARM DELAY TIMEOUT COMPLETED
ARM ALARMS
IS TEMPERATURE OR CO2 LEVEL MORE THAN +/- 0.5 OUTSIDE PROGRAMMED POINTS?
YES
NO
VISIBLE AND AUDIBLE ALARM - MESSAGE ON SCREEN
CANCEL ALARM BY PRESSING ANY KEY
ALARMS CANCELLED
NO
HAVE CONDITIONS RECOVERED TO WITHIN +/- 0.1?
YES
VISUAL AND AUDIBLE ALARMS CANCELLED, MESSAGE LEFT ON SCREEN
CANCEL MESSAGE BY PRESSING ANY KEY

3.6.1 Temperature Sensor System Alarms

There are six temperature sensors: two in the chamber, two in the door and two in the base. If any of these sensors should fail, the following message will appear: °C F.AIL.

Because the incubator can no longer control temperature properly without the failed sensor, the heating will switch off and the incubator will cool down to room temperature.

If, however, a sensor fails but subsequently corrects itself, the temperature control will restart and an alarm message will remain on the temperature side of the display: SAL ... (meaning Sensor Alarm).

This message can be cancelled by pressing any key.

3.6.2 Over-Temperature Cut-out & Alarm

This alarm only occurs if the chamber temperature exceeds the temperature Setpoint by 1°C or if one of the heating elements exceeds a specific activation threshold. The activation threshold is set at the factory and cannot be adjusted.

Following activation, the over-temperature cut-out and alarm system operates in two sequential modes:

Mode 1: The over-temperature cut-out and alarm activates and cuts power to the heating elements and the CO_2 control valve. The condition is shown on the display by the message °CT DIP. When the chamber temperature has fallen to the programmed setpoint, the system changes to Mode 2.

Mode 2: The control system then tries to maintain the chamber temperature at the programmed level by switching the heating elements on and off, using an emergency control method that is, however, less precise. The message TAL will flash on-screen to signal that an over-temperature fault occurred and the incubator is being controlled by the emergency control system. *This message cannot be cancelled via the keypad.*

Normal temperature control can be regained and the over-temperature cutout and alarm can be cancelled by reprogramming the temperature, opening and closing the glass door, or switching the incubator off and back on.

If the problem persists, the alarm will recur; if this happens, please contact your service representative or your distributor immediately.

3.7 CO_2 Auto-Zero System

To carry out an auto-zero press the **enter** & ∗ keys simultaneously. A prompt will appear:

ENT.ER STA.RTS CO2 AUT.O ZER.O

Press the **enter** key to begin the cycle.

The Auto Zero System automatically re-references the CO_2 Sensor to atmospheric CO_2 in the following way:

- A small pump switches on for 2 minutes pumping HEPA-filtered atmosphere at 0.3 liters/minute into the measuring chamber of the sensor. This displaces the chamber atmosphere completely from the sensor.

- At the end of the countdown, the Control System adjusts the auto-zero factor to reference the sensor to 0.05% CO_2 which is the approximate atmospheric level.

- The pump switches off and chamber atmosphere moves back into the measuring chamber of the sensor. This takes 3 minutes after which the normal CO_2 control takes over.

- On completion of the auto-zero a prompt will appear:

  CO2 AUT.O ZER.O IN RAN.GE

  Press the ∗ key to finish the cycle and return to the main display.

- If the CO_2 Auto-Zero *cannot* reference the signal to atmosphere at the end of the Auto-Zero, the following message will appear:

  CO2 AUT.O ZER.O FAI.LED

  This means that the CO_2 sensor is defective and requires replacement. If this occurs, please contact your local distributor immediately.

The default setting for the auto-zero system is 28 days of running time for the incubator. After the incubator has been switched on for a total of 28 days (672 hours), the auto-zero, as described in Section 4, will automatically take place to reference the CO_2 sensor to atmospheric CO_2.

To alter the frequency of the auto-zero press the ▲ and **enter** keys simultaneously and the following message will be displayed: *PRG AZ*

Press **enter** and display changes to *28 DAY*.
By pressing the the ▲ and **enter** keys this value can be changed in steps from *28* to *14*, *7*, *1* or *OFF*.

Press **enter** to confirm the new setting.

If a CO_2 alarm occurs, the auto-zero will automatically take place after 1 minute. This is to confirm that the CO_2 sensor is correctly referenced.

If after a 15-minute delay, the CO_2 is still in an alarm condition and re-alarms, it will again auto-zero.

In the event of high CO_2 alarms, open the inner door for a few seconds to ensure that the CO_2 level drops below setpoint. Also check that the CO_2 pressure is set correctly to 0.35 bar (5 psi).

In the event of low CO_2 alarms, check that the CO_2 supply is present and set to the correct pressure.

4 ROUTINE MAINTENANCE

4.1 General Notes

To ensure that chamber conditions remain as stable as possible, be sure to minimize the length of time that the door is open. To avoid condensation build-up, when you open the door, wipe off any small drops that may have formed on its seal.

If you are using the humidity tray for humidification, be sure to follow the indications provided *in Section 3.3.*

NOTE:
There is no need to remove the top panel for normal maintenance or servicing, so the upper incubator does not have to be moved when you are servicing the lower incubator.

4.2 Daily Checks

1. Check that the temperature and CO_2 levels are reading within specification.

2. Check the reserve pressure in the CO_2 cylinder (normally 725psi or 50 bar when full). The design of the incubator ensures very low consumption of CO_2: during normal working conditions, a typical large cylinder should last approximately 12 months. If there is a significant drop at the cylinder pressure of 725psi or 50 bar, it means that the cylinder is almost empty and should be replaced. Ensuring that there are no leaks at any of the connections will ensure a greater lifetime to the CO_2 supply and will help avoid accidentally running out of CO_2.

3. Any spills in the chamber should be cleaned immediately to protect the stainless steel surfaces.

4.3 Weekly Checks

Refill the humidity tray (to a maximum volume of 2.5 liters). The use of warm water (~ 37.0°C) will ensure a rapid return to optimum chamber conditions.

4.4 Monthly Checks

If required, you can take a sample of the gas inside the chamber using the CO_2 sample port, and check it using a CO_2 gas analyzer. The CO_2 sample port is located on the lefthand side of the incubator (*see Figure 10*).

If you conduct a sampling, please ensure the following:

- Turn off the CO_2 gas by reprogramming the CO_2 setpoint to 0.0% to prevent CO_2 being injected into the chamber, which would give a false reading.
- A flow rate ≤ 0.5 liters/minute is used to take a sample.
- Remember to reset the CO_2 setpoint to the desired level after sampling.

NOTE:

Displayed chamber CO_2 level will drop during sampling, but it will recover once the sampling is complete. This is merely a sensor characteristic; the CO_2 level in the chamber is actually not affected.

5 SERVICE

5.1 Fuse Replacement

To replace a fuse, you will need an ordinary flat-bladed (5mm maximum) screwdriver.

1. Using the flat-bladed screwdriver, rotate the fuse holder (*see Figure 7 for location*) counterclockwise until the fuse holder springs out.
2. Remove the spent fuse.
3. Install a new fuse of the same type.
4. Place the fuse holder back in the side panel and, using the screwdriver, rotate the fuse holder clockwise until it is securely in place.

6 CLEANING & DISINFECTING

6.1 Cleaning

1. Routinely clean the exterior of the incubator by wiping it with a soft cloth, moistened with soapy water.
2. Rinse the soap from the cloth in clean water, and wipe the exterior surfaces again.

CAUTION!

Be sure to use only approved cleaning fluids and materials. Solvents, chloride-based cleaning substances and abrasive materials, among others, may cause permanent damage to the product surfaces. Also be sure to wipe all surfaces dry, leaving them free from any foreign particulates or fluids which could cause subsequent surface damage. (See the CAUTIONs in Section 6.2).

6.2 Disinfecting

The recommended disinfecting agent for use with the incubator is a solution of 70% isopropanol (iso-propyl alcohol) and 30% distilled water. Be sure to follow appropriate safety regulations while you are using this solution (read the WARNING below).

WARNING!

- **As a routine precaution, wear protective gloves.**
- **Be sure to adequately ventilate the work area as you are disinfecting, to avoid the formation of potentially explosive alcohol vapors.**
- **Protect all electrical connections from contact with the alcohol solution.**

To best protect yourself, your incubator and your work area, follow these instructions:

1. Program 0.0% CO_2 and switch off the incubator. Unplug the incubator from the power supply.
2. Dampen a clean cloth with the alcohol solution and wipe down all external surfaces, taking care to keep the alcohol solution from coming into contact with any electrical outlets or assemblies.
3. Remove all of the shelves, the humidity tray, and the shelf racks.

4. Place the black protective cover over the CO_2 sensor.

CAUTION!

It is very important to ensure that no liquid is spilled onto the white porous CO_2 sensor cover at the rear of the chamber. Failure to use the protective cover could result in damage to the sensor and may affect your warranty.

5. You can clean the humidity tray by rinsing it in sterile water, wiping it down with the alcohol solution, and then rinsing it with sterile water.
6. Wipe down the inside of the chamber with the alcohol/water solution, and leave it to dry completely.

CAUTION!

***Never* use any of the following substances to clean the stainless steel or damage will result: Sodium Azide, Aqua Regia, Iodine, Ferric Chloride or Sulphuric Acid.**

7. Wipe the internal components of the chamber twice with the alcohol/water solution. Wipe off excess liquid and leave it to dry completely.
8. Reassemble and reinstall the shelf racks, the humidity tray and the shelves.
9. Be sure to remove the protective cover from the sensor and put it back in the holder for safekeeping (*see Figure 10*). **Be very careful, as you remove the black CO_2 sensor cover, not to accidentally remove the white porous cover. This must remain in place.**
10. Refill the humidity tray (*as explained in Section 3.3*).
11. Turn the incubator on and leave it on for at least two hours (preferably overnight) to allow conditions to stabilize.

7 SPECIFICATIONS

Galaxy 170 S Incubator Specifications	
Temperature Management	▪ Digital programming via microprocessor control on 0.1°C increments. Measurement of chamber, outer door, base & their respective heating elements via 6 RT[1] matched thermistors (sensitivity 0.01°C) ▪ "Out of Limits" temperature protection system independent of microprocessor control.
Range	4°C above ambient temperature[2] to 50°C.
Control	± 0.1°C
Stability	± 0.1°C
Uniformity	≤± 0.3°C
Recommended Ambient Operating Conditions	15-30°C (maximum), optimal range 20-25°C 20-80% relative humidity, non-condensing
CO_2 Control	Solid-state infrared CO_2 sensor operating independent of humidity. Fully-automatic CO_2 zeroing facility.
Range	0.2 - 20%
Control	± 0.1%
Stability	± 0.2%
Uniformity	± 0.1%
Recovery Rate	<0.7% per min (to 90% of setpoint)
Gas Connections	6mm tubing
Required Gas Pressure	0.35bar / 5psi
Relative Humidity	Removable stainless steel humidity tray.
Reservoir Capacity	2.5 liters
Humidity Control	95% at 37°C
Shelves	Polished stainless steel, perforated (standard).
Dimensions (WxD)	520 x 426mm
Number of Shelves	4 standard; up to 8 shelves with multiple position option
Alarm Systems	Two-level alarm system giving programmable audio/visual warnings with options for remote communication. Level 1 signals system failures, level 2 is programmable and monitors chamber conditions.
Dimensions	
Chamber (HxWxD)	693 x 540 x 444mm (27 x 21 x 17.5 in)
Chamber Volume	174 liters
External (HxWxD)	848 x 685 x 677mm (33.4 x 27 x 26.7 in)
External, Crated (HxWxD)	1100 x 830 x 830mm (43 x 33 x 33 in), pallet included
Weight	Crated: 115kg (253.5 lb) Uncrated: 90kg (198.4 lb), with standard features

...continued...

[1] RT = Resistance Temperature curve

[2] If the incubator is to be run close to ambient temperature, it may be necessary to make some adjustments to the control parameters to avoid temperature overshoot. Contact your New Brunswick Scientific representative for details.

Galaxy 170 S Incubator Specifications		
Grounded Electrical Supply		
	Voltage	**Power**
	100V – 120V 50/60 Hz	1300 W
	220V – 240V 50/60 Hz	1600 W
Energy to maintain 37°C:	< 0.1 kWh	
Storage Temperature	10 - 50°C	
Fuses	**120V**	**230V**
	10A	8A

NOTE:

Factory calibration of the incubator is carried out at 37ºC, 5.0% CO_2 and 95% RH, in an ambient temperature of 20-25ºC with no heat-generating apparatus inside the chamber. Using heat-generating apparatus inside the chamber may have an adverse effect on performance.

Software calibration adjustments may be required to optimize performance if the incubator is being used well outside these operating conditions. Performance specifications may also be affected.

For advice on calibration adjustments and relevant performance specifications, contact New Brunswick Scientific. Please be prepared with the model and serial number of your incubator and the complete details of your operating conditions.

8 OPTIONS & ACCESSORIES

Most options must be factory-installed, while some may be retrofitted on-site by authorized service personnel. Some combinations of options may not be possible, and some options may incur extra cost: please inquire before ordering.

Option/ Accessory	NBS Part No.	Retrofitable
BMS Relay Contact Alarm	P0628-5541	Yes
Four Inner Glass Doors	P0628-6780	Yes
Eight Inner Glass Doors	P0628-6781	Yes
Left Opening Door (hinged at right)		No
Internal IP66 Power Socket	P0628-5560	No
Copper Chamber	P0628-5612	No

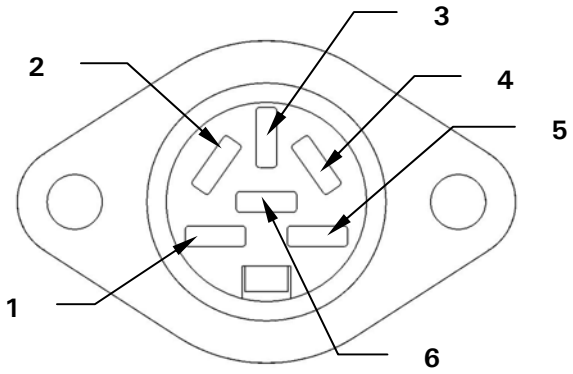
8.1 BMS Relay Contact Alarm

The BMS (Building Management System) Relay Contact Alarm allows a signal from a central alarm system to be switched ON or OFF to indicate an alarm condition at the incubator.

The following alarms would activate the system: over-temperature, under-temperature, system failure, CO_2 high and CO_2 low. The alarm is programmed to indicate when there is a power failure or electrical fault (power surge or short circuit, for example). The alarm may also respond to other alarm situations, according to other options installed on the system.

The system connection is via a standard 6-pin DIN socket on the rear panel of the incubator (*see Figure 10 for location & Figure 12 for detailed look*). The matching plug is provided when the option is installed.

Figure 12: BMS Relay Contact Alarm Socket



See Table 5 below for the designation of the six pins.

Table 5: BMS Relay Contact Alarm Socket Pin Designation

Pin	Designation	
1	12VDC unregulated	To power external equipment such as a remote buzzer or light. (100mA maximum)
2	0V	
3	5VDC	Via 10KΩ pull-up resistor, provides logic signal to directly control an auxiliary control system.
4	Normally closed	To access the relay contacts. Contact limits are 3 Amps @ 24V DC and 3 Amps @ 34 VAC.
5	Common	
6	Normally open	

The default setting for the alarm system is OFF. To activate the relay using the incubator keypad:

1. Press the **enter** and ▼ keys simultaneously to enter the Alarm Program Mode.
2. Press the ▲ key until *REL AY* is shown in the display.
3. Press the **enter** key to select the option.
4. The default setting is *NO* (OFF); press the ▲ key to change the display to *YES* (ON) or press the ▼ key to return the display to *NO* (OFF).
5. Press the **enter** key to accept the selection.
6. To return to the temperature and CO_2 display screen, press the ✱ key twice.

8.2 High Temperature Disinfection

High temperature disinfection is designed to heat the internal chamber to 120°C, maintain that temperature for 4 hours, and then allow the chamber to cool down to 37ºC (or the programmed temperature) when normal control takes over.

The incubator must be cleaned, disinfected chemically, and dried thoroughly before starting the process. The inner and outer door seals must be cleaned carefully and all surfaces wiped with disinfectant (*see the instructions in Section 6*).

NOTE:

- **Overly vigorous cleaning may damage the seals.**
- **The shelves and humidity tray should also be in place during the cycle.**
- **The black PVC protective CO_2 sensor cover must be removed before starting a cycle.**
- **The white porous CO_2 sensor cover can remain in place, although it may suffer damage over time during the high temperature disinfection cycle. Replacement covers are available; see Section 8.6 for information.**

CAUTION!

The chamber walls and CO_2 sensor all achieve temperatures of 120°C, particularly in areas that are inaccessible to chemical disinfection. Certain areas of the glass door and inner door seal surface temperatures will be somewhat lower (at 115°C ± 5°C). This is the minimum temperature necessary to eliminate Bacillus Subtilis, which is the standard organism specified by the US Pharmacopeia to validate sterilization of chamber interiors.

It is important that these areas be chemically disinfected prior to running a high temperature disinfection cycle to ensure effective disinfection.

WARNING!

The incubator MUST be clean and dry before you continue. If it is not, major and permanent damage may occur.

WARNING!

DO NOT open the door during the disinfection cycle because of the dangerously high temperatures involved. Serious burns could occur if the door is opened during the cycle.

To begin the disinfection process:

1. Simultaneously press the ▼ and ∗ keys. The display will change and the following prompt will appear:
   HOT. DECON CYC.LE ENT.ER STA.RTS.
2. Press the **enter** key to begin the cycle (or press the ∗ key to cancel the operation). The **enter** key command will only be accepted when the entire message has been displayed at least once.
3. When the disinfection cycle starts, the display will show another prompt:
   IS INS.IDE CLE.AN AND.DRY.
4. Press the **enter** key again (or press the ∗ key to cancel the operation). The **enter** key command will only be accepted when the entire message has been displayed at least once.

During the three stages of the disinfection cycle, the display keeps the user informed by scrolling through a sequence of messages as shown below:

- Current chamber temperature (in °C) and time remaining (hours & minutes) are indicated as 120.2.45 (i.e., 120°C with 2 hours and 45 minutes remaining).
- Every 10 seconds, by flashing one of the following messages for one second, the display will indicate which disinfection stage the incubator is in:
  - HE.AT (heating to 120°C)
  - DEC.ON (maintaining 120°C) or
  - CO.OL (cool down).
- The time displayed counts up during the heat and cool stages, but it counts down from 4 hours during the disinfection stage. After the cool down phase is completed, the following messages will be displayed depending on the outcome:
  - DEC.ON PAS.SED or
  - DEC.ON FAI.LED
- If the message says that disinfection failed, it will be followed by any combination of the following messages:
  - FAL.L DUR.ING HEA.T (this indicates that the temperature dropped more than 2°C over a 60-second period during the heating phase)
  - FAL.L DUR.ING DEC.ON (this indicates that the temperature fell below 118.0°C during the disinfection phase)
  - RIS.E DUR.ING COO.L (this indicates that the temperature rose more than 2°C over a 60-second period during the cool down phase)

    or
  - CAN.CEL BUT.TON PRE.SS (this indicates that the CANCEL button was pressed during the heating or disinfection phase)

If more than one of the above-mentioned events occurred, the messages will be displayed consecutively in the sequence in which the events occurred.

The disinfection cycle can be cancelled at any time by pressing the * key.

If the chamber temperature rises above setpoint or the element temperature is greater than the total of chamber setpoint + chamber low control point temperature, the system will automatically begin cool down until these conditions are satisfied.

If the incubator door is opened—*a procedure that is highly discouraged because of the dangerously high temperature inside the chamber*—during a disinfection cycle, the process will continue as normal. A failure message will, however, appear if the temperature falls as a result of the door opening during either the heating phase or the disinfection phase.

If the incubator power is cycled OFF then ON, the incubator will power up as normal. This condition will be indicated by an absence of a completed disinfection status message (either DEC.ON PAS.SED or DEC.ON FAI.LED)

If the chamber temperature is above 65°C, the display will read 65.0 until the temperature drops below 65, and a °CF.AIL alarm will occur since the control system cannot measure temperatures above 65°C in normal mode.

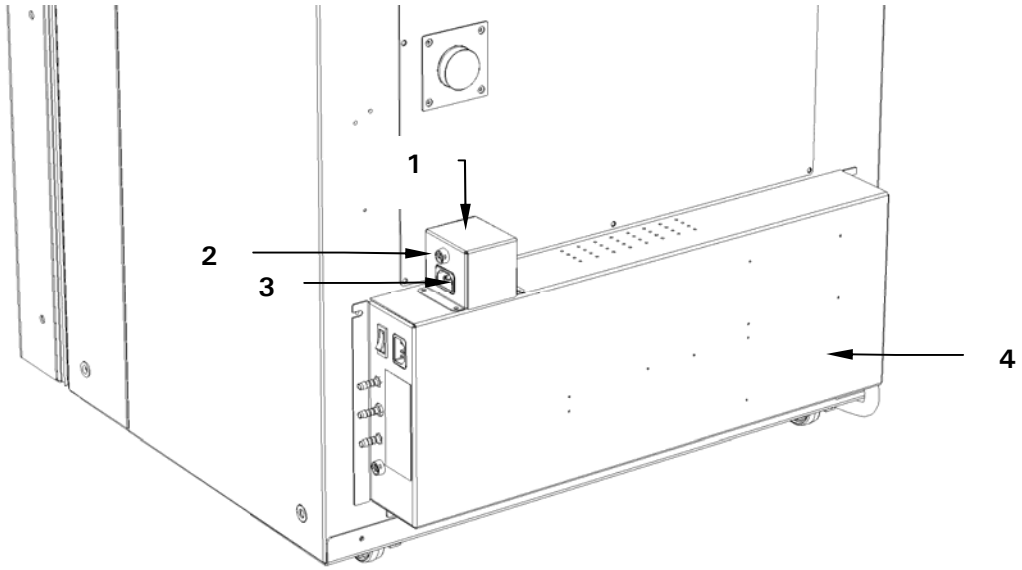
8.3 IP66 Sealed Power Outlet Socket

> ***WARNING!***
> **Both the incubator and the IP66 enclosure must be plugged into an electrical supply protected by an RCD device. Any device chosen must be a "self-resetting" type which will automatically reconnect power to the incubator as soon as power is restored after a power failure.**

The IP66 Sealed Electrical Outlet Socket is designed to provide a safe and convenient means of using electrically powered equipment within the incubator chamber. The IP66 socket is powered on a completely separate circuit and therefore has its own plug, lead and fuse.

The socket is located on the back wall of the chamber, on the righthand side between the second and third shelf. The socket is powered by an independent power inlet located above the equipment box at the rear of the incubator (*see Figure 13 on the following page*). The socket also has an independent fuse which is rated at 4 Amps. There is a dedicated switch for this socket, illuminated green when it is on; the switch is located on the left front of the incubator.

Figure 13: IP66 Enclosure (rear view of incubator)



1	IP66 enclosure	3	IP66 power inlet
2	IP66 fuse holder	4	Equipment box

CAUTION!

Working with electrical power inside a humid environment (where the incubator is humidified) can be hazardous. The following precautions should be observed:

- **The instrument or equipment, and its external connections, to be used inside the chamber should be specified as suitable for use in a humid environment, and at 37°C (see also "Using Powered Equipment within the Chamber"). If in doubt, consult with the manufacturer of the equipment.**
- **Always ensure the connections are properly and securely made.**
- **Be sure to switch OFF the green illuminated switch on the front left of the incubator before connecting or disconnecting equipment inside the chamber.**
- **The Sealing Cap must *always* be in place when the socket is not in use.**
- **Both the incubator and the IP66 enclosure *must* be plugged into an electrical supply protected by an RCD device. Any device chosen must be a self-resetting type which will automatically reconnect power to the incubator as soon as power is restored following a power failure.**

NOTE:

If the incubator is to be used humidified, the normal RH level is ~ 95%, so any electrically powered equipment or device to be used inside the chamber must be designed for use in a humid atmosphere. Consult the manufacturer of the equipment to ensure that it is suitable.

To minimize the thermal gradient within the chamber, the device should be placed on the bottom shelf. The heat dissipated by the equipment should be as low as possible to minimize thermal disturbance to the chamber. Some shakers, stirrers, etc. have been specifically designed to give a low heat output for use in incubators. The maximum heat that can be dissipated within the chamber is variable, depending on the difference between the ambient and programmed temperatures. If the heat dissipated is too great, the chamber will tend to overheat. If this happens, the control parameters can be adjusted to compensate.

NOTE:

Any heat-generating equipment used inside the chamber will naturally affect the temperature performance of the incubator.

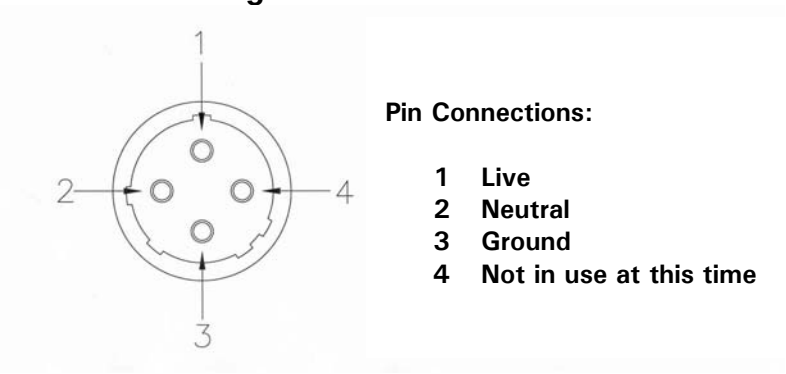
Factory testing can be carried out with the specific apparatus to ensure that the control conditions can be met.

To connect to the socket inside the chamber, a power cable with a matching IP66 plug is supplied. This power cable should be fitted by a qualified person to the equipment or device to be used inside the chamber. If the cable cannot be fitted, contact your distributor, giving details of the connectors required, so they can supply a suitable lead.

CAUTION!

The Electrical Socket and the matching plug are both sealed to IP66 and are capable of being heated to 120°C during the High Temperature Disinfection cycle, but the electrical cable is *NOT* rated for use at 120°C. Therefore, the equipment or device and the connecting cable should be removed from the chamber, and the Sealing Cap replaced on the socket prior to starting a High Temperature Disinfection cycle.

Figure 14: IP66 Socket



8.4 Other Options

Four and eight inner glass door options are available which help to reduce the loss of CO_2, temperature and humidity conditions when the chamber door is opened.

8.5 Copper Inner Chamber

NOTE:

Copper naturally changes color: this incubator had a bright finish when it was manufactured. The dull finish is a result of oxidation of the copper surface and it is the properties of this oxidation that create the important antimicrobial surface.

8.6 Available Accessories

Accessories	NBS Part Number
Two Stage CO_2 Regulator	P0628-5010
CO_2 Supply Line HEPA Filter	P0628-5020
CO_2 In-line Pressure Regulator	P0628-5030
CO_2 Cylinder Auto-Changeover Controller	P0628-5000
Auto-Zero HEPA Filter	P0628-5060
CO_2 Gas Analzyer Kit	P0628-5040
Spare CO_2 Gas Analyzer Tubes	P0628-5050
Electronic CO_2 Gas Analyzer	P0628-6150
Electronic CO_2/O_2 Gas Analyzer	P0628-6631
Electronic CO_2/O_2/Humidity/Temp Analyzer	P0628-6632
Additional Shelf, Perforated	P0628-6251
Additional Shelf, Non-Perforated	P0628-6241
Additional Humidity Pan	P0628-6260
Stacking Kit and Stand	P0628-6270
Stacking Kit with Casotrs	P0628-6490
Spare CO_2 Sensor	P0628-5700
Spare O_2 Sensor	P0628-5790

9 CE CERTIFICATION

New Brunswick
an eppendorf company

CE CONFORMITY CERTIFICATION

DECLARATION OF CONFORMITY

RS Biotech Laboratory Equipment Limited
1 Drummond Crescent,
Riverside Business Park,
Irvine, Ayrshire, KA11 5AN,
Scotland, UK

Declare that the Galaxy 170 S CO_2 Incubator to which this declaration relates is in conformity to the following standards:

EN 61010-1: 2001
Safety requirements for electrical equipment for measurement, control, and laboratory use.
Part 1: General requirements.
Class 1, Installation Category II, Pollution Degree 2

EN 61010-2-010: 2003
Safety requirements for electrical equipment for measurement, control, and laboratory use
Part 2-010: Particular requirements for laboratory equipment for the heating of material.

EN 61326-1: 2006
Electrical equipment for measurement, control and laboratory use - EMC requirements.

Following the provision of:

2006/95/EC The Low Voltage Directive
and its amending directives
2004/108/EC The Electromagnetic Compatibility Directive
and its amending directives

This equipment should not be used in a residential area.

Mike King

Managing Director of UK Operations

27th March 2009

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